VARIATION IN CENTRAL AMERICAN FLICKERS

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While investigating hybridization and its effects on flicker populations, I undertook a general study of variation in the two North and Middle American species, *Colaptes auratus and C.* (*Nesoceleus*) *fernandinae*. For reasons presented elsewhere (Short, 1965*a*) the five major groups of *C. auratus*, namely the *auratus*, *cafer*, *chrysoides*, *chrysocaulosus*, and *mexicanoides* groups, are considered conspecific. (A vernacular name for this assemblage is difficult to arrive at; perhaps "Black-breasted Flicker" best describes and distinguishes *C. auratus*.) The present paper deals with variation in the allopatric Central American *mexicanoides* subspecies group of *Colaptes auratus*. This group is currently comprised (Peters, 1948) of the races *mexicanoides* and *pinicolus*, which are usually regarded (Peters, 1948; Blake, 1953; Eisenmann, 1955; Miller, et al., 1957) as part of the "species" *Colaptes cafer*. I have elsewhere dealt with variation in the allopatric, West Indian *chrysocaulosus* subspecies group of *C. auratus* (Short, 1965*b*), and variation in the *mexicanoides* group will be treated similarly. Mensural and plumage features of this widespread species of flicker are highly variable, and their plumage patterns lend themselves to study because they are composed of discrete elements such as bars, spots, and patches.

MATERIALS AND METHODS

The study of Central American flickers was hampered by lack of specimens from various areas within this region of diverse terrain and habitats. For the sake of comparison with other populations of flickers, attention was focused primarily on late winter, spring and early summer specimens, i.e., those taken roughly during the breeding season. Seasonal variation was considered, and specimens collected at other times of the year were also included in the analysis when no seasonal variation was noted. Only adult flickers are considered here, as variation in the juvenal plumage of *Colaptes auratus* will be discussed elsewhere. The total number of adult specimens from which data in the report were gathered is 160. These include 90 males and 70 females from Mexico (Chiapas), Guatemala, El Salvador, Honduras, and Nicaragua.

Sample sizes were insufficient to make locality by locality comparisons. Available specimens were therefore grouped into five composite samples, although this procedure is admittedly less desirable. Figure 1 depicts localities represented by specimens used in this study, and also shows the segregation of composite samples. These will hereafter be designated the Chiapas, Guatemala, El Salvador, Honduras, and Nicaragua samples.

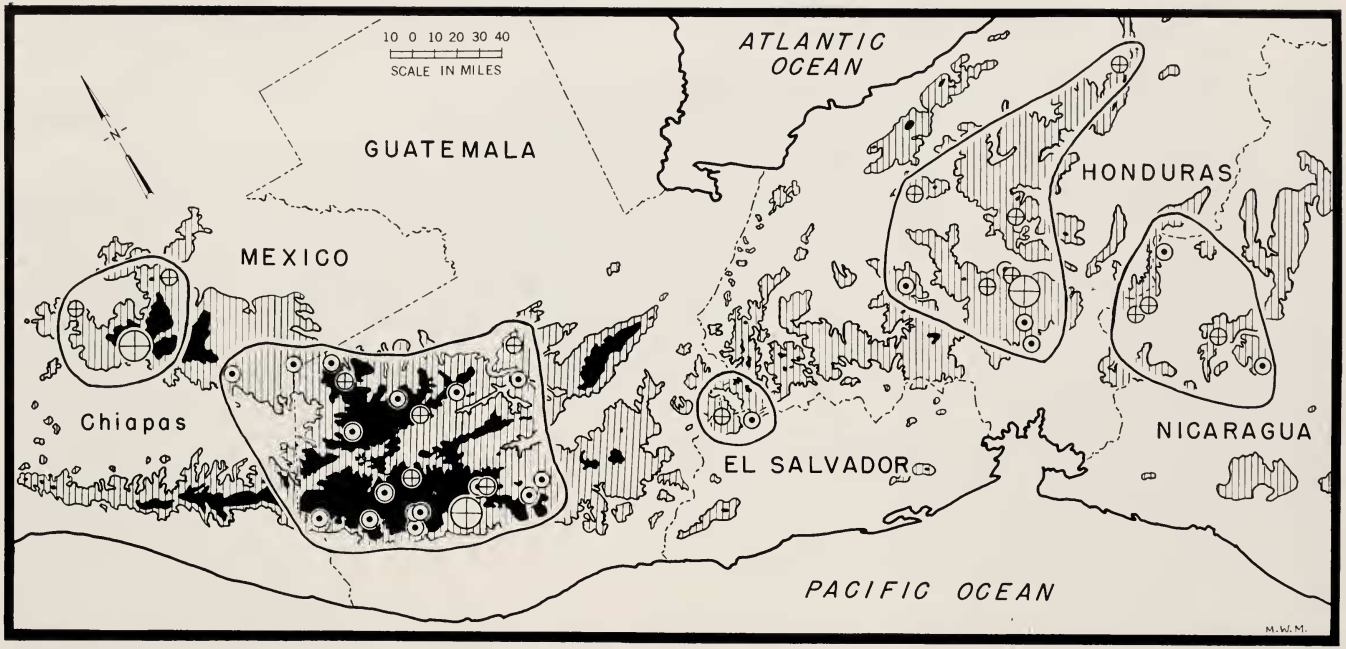

FIG. 1. Central America showing localities represented by flicker specimens used in this study. Localities represented by three or more specimens are marked with a cross, while circles enclosing a spot denote localities represented by one or two specimens. Composite samples described in the text as Chiapas, Guatemala, El Salvador, Honduras, and Nicaragua samples come from the five regions (from left to right, respectively) enclosed within the heavy lines. Areas over 2,000 meters in elevation are shown in black, while areas between 1,000 and 2,000 meters in elevation are indicated by vertical lines. The map, including the contour intervals was drawn from the American Geographical Society 1 : 1,000,000 maps.

The composite Nicaraguan sample was secured in the mountains of northern Nicaragua, with specimens principally from San Rafael del Norte (total Nicaraguan sample = 8♂♂, 5♀♀). The Honduran sample mainly represents east-central Honduras, and includes moderate-sized samples from Subirana, Rancho Quemado, Cantoral, El Hatillo, and the vicinity of Tegucigalpa (total sample = 25♂♂, 20♀♀). The El Salvador sample comes principally from Los Esesmiles, Department of Chalatenango (total sample = 7♂♂, 6♀♀). This composite sample, representing the small highland area of El Salvador, includes the only flickers available from central Honduras to east-central Guatemala; it is effectively a "West Honduran" sample.

The Guatemalan composite sample (33♂♂, 33♀♀) is principally derived from central and west-central Guatemala, with the following major localities: Lake Atitlán area, Momostenango, Nebaj, and San Mateo. It also includes the eastern-most Chiapan localities Comitán, 25 miles SE Comitán, and Volcan de Tacaná. The Chiapas sample (7♂♂, 6♀♀) comes from three areas in the central Chiapas highlands (Ocosingo, Pueblo Nuevo, San Cristóbal de las Casas). The diversity within samples, particularly the Guatemalan sample, somewhat restricts comparisons. The statistics presented below for the composite samples reflect their variability, and are valid for the specimens being analyzed.

Standard taxonomic procedures were used in the investigation. Measurements taken were: wing length (chord), tail length, bill length (from nostril, except as noted) and tarsal length. Data concerning some 30 quantitative and qualitative characters were utilized in this study. Information derived from study of some 5,000 specimens of flickers and their relatives (both sexes and all age groups) provided a broad basis for considering variation in Central American flickers.

ECOLOGY AND BEHAVIOR

Little is known of the ecology and behavior of the *mexicanoides* group of flickers. The birds occur primarily in open pine forest and pine-oak woodland at various altitudes. Although generally found at elevations over 5,000 feet in Guatemala (Griscom, 1932; Land, 1962), they at least occasionally descend to much lower altitudes. Dickey and van Rossem (1938) reported flickers occurring in El Salvador down to 2,400 feet, and a female specimen in the American Museum of Natural History (No. 326633) was taken at 2,050 feet in Honduras. These flickers are similar to other North American flickers (*Colaptes auratus*) in habits and behavior. They sufficiently resemble the *cafer* subspecies group that most workers (see citations above) consider them as part of *Colaptes "cafer."* Dickey and van Rossem (1938:309) write of *mexicanoides* as follows: "There appears to be little or no difference, in the ecological niche occupied, between these El Salvador flickers and their northern congeners. In call notes, habits, choice of nesting sites, and appearance in life, they are scarcely, if at all, to be distinguished from *Colaptes cafer.*" Wetmore (1941:547) found Guatemalan *mexicanoides* like "typical flickers in appearance," but considered their calls "quite different from the

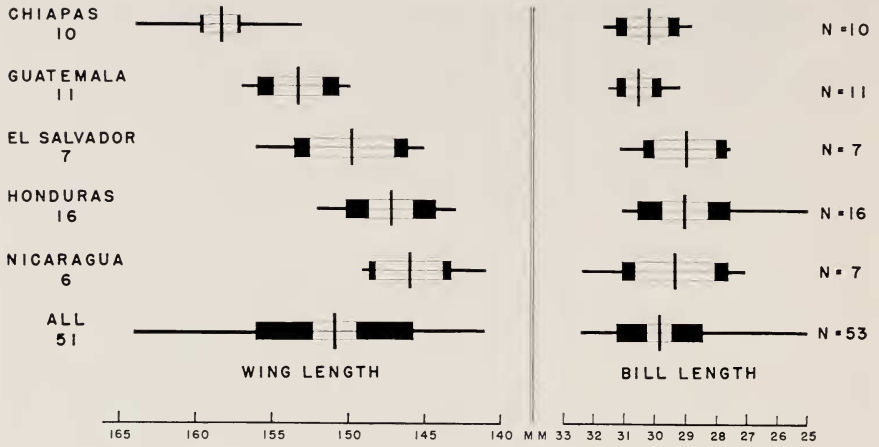

FIG. 2. Analysis of wing length and bill length in male Central American flickers. The dark vertical lines indicate the means, and the horizontal lines the ranges of variation in the samples. The white rectangle includes two standard errors around the mean, and each black rectangle includes one standard deviation on both sides of the mean.

notes of the northern species." Further observations of the behavior and ecology of Central American flickers, comprising the southernmost (and an allopatric) population of *Colaptes auratus*, should be encouraged.

CHARACTER ANALYSIS

Wing Length

Variation in wing length is considerable, individual variation being pronounced to the extent that female sample means are in several instances greater than those of males. The geographical variation is clinal, with northwestern birds (Chiapas) having wings averaging 9–12 millimeters longer than those of southeasternmost flickers (Nicaragua). The cline for males (Fig. 2) has its steepest gradient between Guatemala and El Salvador, while that for females is steepest from El Salvador to Honduras. The longest-winged male is from Chiapas and the shortest-winged male from Nicaragua; the female with the longest wings is from Guatemala and that with the shortest wings from Honduras. Nicaraguan and Honduran birds do not overlap Chiapas specimens in wing length, but do overlap measurements of Guatemalan birds. El Salvador flickers are intermediate between those from Honduras and Guatemala, and their variation is sufficient to overlap extreme samples from Nicaragua and Chiapas. Females have wings averaging but slightly shorter than those of males.

Tail Length and Tail: Wing Ratios

There is a general cline of decreasing tail length from northwest to southeast, with the tails of Chiapas birds averaging only 5–8 millimeters longer than those of Nicaraguan flickers (Fig. 3). The cline is less marked than that for wing length. El Salvador birds (both sexes) average closer to Chiapan flickers than do those from Guatemala. Despite the small size of the Nicaraguan samples, both male and female ranges overlap those of

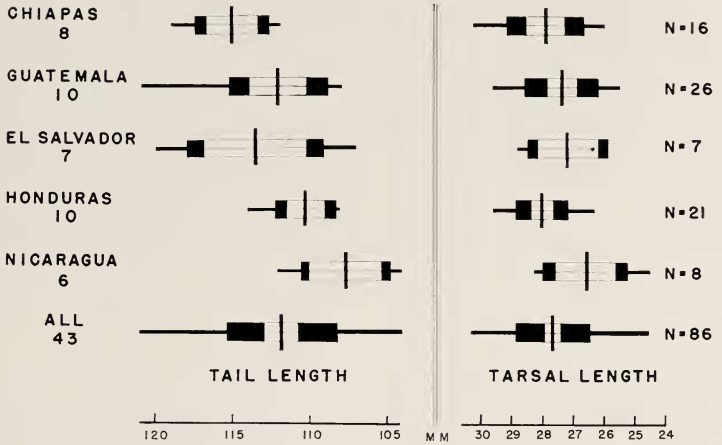

Fig. 3. Analysis of tail length and tarsal length in male Central American flickers. The dark vertical lines indicate the means, and the horizontal lines the ranges of variation about the means. The white rectangle includes two standard errors around the mean, and each black rectangle includes one standard deviation on both sides of the mean.

the Chiapas samples. The southeastern flickers tend to have proportionally longer tails than those from Chiapas and Guatemala, as the Honduran-Nicaraguan birds show tail length 4.5–6% and wing length about 7% shorter than those of Chiapan flickers. Females' tails average less than 1% shorter than those of males.

Bill Length

This feature is variable in flickers, and the Central American birds are no exception. The more southeastern flickers have slightly shorter bills, but the average difference in samples of both sexes is only a little over one millimeter (Fig. 2). The small Chiapan and Nicaraguan female samples are virtually alike in bill length. Particular attention was devoted to this character, for a chief characteristic of Dickey and van Rossem's (1928) race *pinicolus* is its shorter bill. Their measurements of the culmen from its base (op. cit., p. 131) are:

pinicolus —7 ♂ ♂ (El Salvador) —38.9–41.6 mm, mean 40.1 mm
mexicanoides—4 ♂ ♂ (Chiapas) —42.4–44.6 mm, mean 44.0 mm

I obtained the following measurements of the culmen (from the base):

Chiapas —6 ♂ ♂ —41.7–43.3 mm, mean = 42.73 mm
Guatemala —6 ♂ ♂ —42.8–44.4 mm, mean = 43.35 mm
El Salvador —5 ♂ ♂ —38.8–41.9 mm, mean = 40.78 mm
Honduras —7 ♂ ♂ —39.4–42.5 mm, mean = 41.31 mm
Nicaragua —7 ♂ ♂ —38.6–43.4 mm, mean = 40.63 mm

El Salvador birds, from data for both kinds of measurements, do indeed appear to have shorter bills than those from Guatemala and Chiapas. However, the sample from El Salvador is small, and flickers from farther southeast are variable enough to overlap considerably with northwestern birds. In fact, the Nicaraguan sample for the bill length

from nostril measurement (Fig. 2 for males; females also show this) and for culmen length from the base of the bill, *completely* overlaps measurements of the Chiapan birds. Considering the great variability of bill length in flickers, the difference between El Salvador and Guatemalan-Chiapan flickers is minor. Individual variation dependent upon psychological and/or food availability factors results in variation in bill wear. An example of such effects is shown by comparison of two flickers for various bill measurements:

Specimen	a. bill length (from nostril)	b. bill length (exposed culmen)	c. bill length (culmen from base)	c. minus a
♂ Univ. Calif. Los Angeles 18375 (El Salvador)	30.8 mm	37.7 mm	41.9 mm	11.1 mm
♂ Univ. Calif. Mus. Vert. Zool. 115400 (Chiapas)	28.8 mm	37.0 mm	43.3 mm	14.5 mm

Thus, the "shorter billed" Chiapas flicker (taken April 7) has a much longer bill base and a worn bill, while the "longer-billed" El Salvador bird (taken February 19) exhibits a shorter bill base and longer bill tip. Because of the effects of wear, minor bill length differences are hence rendered unsatisfactory for defining populations of flickers. Bills of females average 3–4% shorter than those of males.

Tarsal Length and Ratios

Considerable individual variation in tarsal length was evident, and means for the Chiapan to Honduran samples are within a millimeter or so of each other (Fig. 3) with great overlap. Despite a significant difference between Honduran and Nicaraguan samples, overlap of both with other samples lessens its importance. Tarsal length thus shows no apparent geographic variation in the northwestern four samples, but appears to diminish between Honduras and Nicaragua. The tarsi of females average 1–2% shorter than those of males. Due to the greater variation in bill length, and considerable variation in tarsal length, ratios of tarsal length : bill length are highly variable. The total range for 110 adults is 0.79–1.08, the same as the range for the single Guatemalan sample.

Wing Shape and Length of 10th Primary

The non-migratory Central American flickers have relatively shorter, more rounded wings than their relatives to the north, including *C. a. mexicanus*. In fact, their wings are shaped very like those of the *chrysocaulosus* subspecies group (also non-migratory) of the West Indies (Short, 1965*b*). The more rounded shape of the wings in *mexicanoides* is caused by its generally short central primaries (P5–P8), and its fairly long outer (P9, P10) and inner (P1–P4) primaries. The fourth primary is almost as long as P8 in this form, not considerably shorter as in more northern races of *C. auratus*. The third primary is considerably longer than P9, P2 is as long as or (usually) longer than P9, and P1 may be as long as P9.

The tenth primary is closely similar in length among individuals of the various samples. El Salvador and Honduran birds have this primary the same size or longer than those of Guatemalan and Chiapan birds, while the tenth primaries of Nicaraguan flickers are

barely shorter. Mean P10 lengths and sample sizes are as follows (measurements in millimeters):

	Chiapas	Guatemala	El Salvador	Honduras	Nicaragua
♂	41.80 (5)	40.56 (9)	42.60 (5)	41.33 (9)	39.14 (7)
♀	–	39.11 (18)	42.60 (5)	40.38 (8)	39.60 (5)

Lack of a cline in P10 length renders this primary proportionally longer in the shorter-winged southeastern populations.

Mean measurements of the ninth primary follow (these measurements are taken from the tip of the feather to the skin around the base of the feather):

	Chiapas	Guatemala	El Salvador	Honduras	Nicaragua
♂	96.60 (5)	93.83 (6)	95.60 (5)	90.63 (8)	90.14 (7)
♀	–	94.07 (14)	96.3 (4)	88.63 (8)	90.40 (5)

Birds from El Salvador have longer ninth primaries, like Chiapan and Guatemalan birds. However, the longer tenth primary in El Salvador flickers renders that sample more like birds from Honduras than those from Nicaragua in the P10 : P9 ratio. A "*t*" test of the difference in the length of P9 between Guatemalan-Chiapan and Honduran-Nicaraguan flickers gave "*t*" values indicating a highly significant difference ($P = 0.001$ or less) for both sexes.

Breast Spotting

As noted by Lafresnaye (1844) in describing *mexicanoides*, this form has more transverse, bar-like spots than northern flickers. Only one of 91 adults had spots deeper than broad. Depth and width of a "normal" central breast spot were measured in each specimen. Averages for the five samples ranged as follows:

	Range of average breast spot depth	Range of average breast spot width
♂ ♂ —	3.7–4.3 mm	5.4–6.1 mm
♀ ♀ —	3.7–4.4 mm	5.4–7.5 mm

Chiapan flickers have rounder spots than those of the other samples (mean difference between spot depth and spot width = 1.37 mm in 15 Chiapan adults, and 2.15 mm for 79 adults from southern Chiapas to Nicaragua). Females tend to have broader spots than do males. More breast spots are visible per unit area in *mexicanoides* than any other subspecies group except *chrysocaulosus*.

The strong tendency toward barring in this form is also indicated by the fact that the lower abdomen was barred in all but two of 77 adults checked for this feature. The other two birds showed chordate bars, and none exhibited spots. As in other flickers the females tend to be more strongly barred than males.

Breast Patch

Like the *chrysoides* and *chrysocaulosus* subspecies groups, *mexicanoides* has a deep round, rather than narrow, crescentic breast patch. The depth of the patch is variable, and the northwestern samples (Chiapas-Guatemala) in particular show very deep breast patches. A statistical treatment of the data is presented in Figure 4 (males only). The difference between the northwestern two and southeastern three samples is considerable, of the order of 12–18%, compared with only a 6–7% wing length difference between the extreme samples. Besides this geographic variation, *mexicanoides* exhibits a rather considerable sexual difference in breast patch depth.

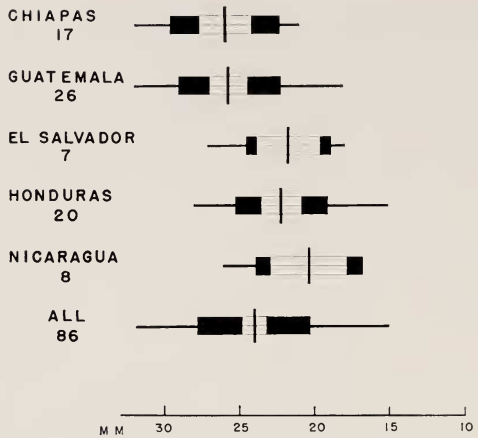

FIG. 4. Analysis of breast patch depth in male Central American flickers. The measurement is of the maximum depth of the breast patch. Vertical lines denote means, horizontal lines indicate the ranges of variation within the samples. Each white rectangle includes two standard errors around the mean, and each black rectangle includes one standard deviation on both sides of the mean.

Malar Patch

The male malar patch in *mexicanoides* is variable in color, from red mixed with considerable black, to red. An anterior area before the red-black portion is colored cinnamon-rufous, and averages 11% (sample means 9–13%) of the total malar region. Utilizing malar color scores fully described elsewhere (Short, 1965*a*), the specimens were assigned scores of "2"–"4" (briefly, "2" = 25–75% red, rest black; "3" = about 1–24% black; and "4" = all red). Considerable individual variation was encountered, especially in the northwestern samples. The following scores were attained by 87 males: "2" = 12, "3" = 73, "4" = 2.

Females generally have cinnamon-rufous malar patches, with black or red visible on the surface in 18 of 39 adults (46%). Shafts of the females' malar feathers are black at their bases. Gray color is lacking in malars of 79% (29 of 39) of the females, and when present is found only in traces (up to 15% of malar area in one Honduran female). Eight of the ten birds showing gray color are from the southeastern three samples. Only one of 36 males showed gray color amid the cinnamon in the anterior part of its malar patch, and that male is from Honduras. The southeastern flickers thus show less black in the male malar patches and more gray traces in those of females.

Back Barring

Perhaps the most striking feature of *mexicanoides* is its much broader back barring. Statistical treatment of data for back bar depth of all adults follows:

	N	$\overline{X} \pm 2$ SE	SD	Range	Coeff. Var.
♂ ♂	88	3.65 ± 0.10 mm	0.45 mm	2.3–4.8 mm	12.33%
♀ ♀	68	3.65 ± 0.10 mm	0.41 mm	2.6–4.6 mm	11.23%

There is no sexual difference in *mexicanoides*, though females of other subspecies groups of *Colaptes auratus* have broader bars than males. Back bar depth is much greater than

in all other forms of *C. auratus*, including the *chrysocaulosus* group. There is no apparent geographic variation in this character.

Test (1940) showed that *mexicanoides* has broader dark back bars than other North American flickers, and pointed out that the light brown interspaces between the dark back bars of *mexicanoides* are of the same width or narrower than the dark bars (in contrast to the situation in other forms of *Colaptes auratus*, which have interspaces always broader than the bars). He also noted that the interspaces are often two shades of brown, being duskier near the black bars and more cinnamon-rufous away from them. This imparts a tri-colored effect to the back color, an effect not noted in other North American flickers. Bars on the upper wing coverts of *mexicanoides* are also broader than in other North American flickers.

The number of dark bars on the back feathers is also greater in *mexicanoides*. The number of complete and incomplete (bars noted as ⅓, ½, ⅔ complete or incomplete) bars was counted on an upper back feather of 76 adults. No sexual difference was evident, the male mean being 2.51 and that for the females 2.46 (means for more northern flickers vary between 1.4 and 2.1). Sample means clustered around 2.5, and no geographic variation was noted. The dark bar at the tip of each back feather was not counted. These bars are small, but of sufficient depth so that some breeding birds with worn feathers still possess them (in contrast, flickers from farther north have narrower black tips, nearly always worn off by the breeding season).

Back Color

The backs of these flickers are rich, cinnamon brown to rufous brown, marked with dark bars which are often (especially in southeastern populations) buff-bordered. Chiapan birds average darker than the others, and show less variability. Guatemalan flickers are highly variable, and exhibit the light and dark extremes of *mexicanoides*. Samples from El Salvador, Honduras, and Nicaragua contain mostly lighter colored birds, but a few Honduran individuals match the darkest Chiapan flickers. Females do not differ from males in back color. Seasonal variation is considerable, the back color being much darker in fall birds than in those taken during the breeding season.

Rump Markings

North American flickers generally exhibit a white rump patch. This patch is, however, partly obscured by spots or bars in occasional individuals of the *auratus*, *cafer*, and *chrysoides* subspecies groups, while the *chrysocaulosus* and *mexicanoides* groups generally have spotted and/or barred rumps. Scores were assigned as follows:

Score	Condition of rump markings
0	White, no markings
1	1–6 spots or bars
2	More than 6 bars or spots, but rump largely white
3	Many markings, but one or several areas of white with no marks
4	Barred and/or spotted throughout

Central American flickers generally have rump patches scoring "2" or "3," but scores range from "1" to "4." Females consistently show higher scores, as in all populations of *Colaptes auratus*. Geographic variation is slight, and principally involves reduction of markings in the southeastern populations. Nicaraguan flickers especially exhibit less barring or spotting in their rumps, and seven of the ten individuals scoring "1" come from Nicaragua and Honduras. The lowest number of marks found was two, in a Nicaraguan flicker. The average score for all Central American males was 2.63 ($N =$

87, SE = 0.03, SD = 0.84), and for all females 2.92 ($N = 68$, SE = 0.11, SD = 0.87). These compare with scores of 3.48–3.95 for samples of Cuban and Grand Cayman populations representing the *chrysocaulosus* group. Part of this difference is due to the rather smaller markings in *mexicanoides* compared with *chrysocaulosus*, but the latter obviously has a more heavily marked rump (only 19% of all *mexicanoides* score "4," while 84% of *chrysocaulosus* do so). Higher scoring individuals tend to have more barring and less spotting on their rumps. About half the specimens of *mexicanoides* examined showed markings predominantly bar-like, while the others exhibited spots only.

Upper Tail Covert Pattern

Variation in upper tail covert pattern in *Colaptes auratus* has been figured by Chapman (1891) and Short (1965*b*). Although considerable variation exists in the *cafer* and *auratus* subspecies groups, there is less variation in the *chrysoides*, *chrysocaulosus*, and *mexicanoides* groups. The patterns exhibited have been categorized as all black, V-striped, horseshoe-tipped, and barred (20 examples of these patterns are figured in Short, 1965*b*). The patterns grade into each other, and innumerable intermediate conditions are possible. Although many individuals of the northern populations (*auratus* and *cafer* subspecies groups) show black, V-striped, and horseshoe-tipped patterns, these are uncommon and barred patterns nearly universal in the other subspecies groups. Considering only the large, central upper tail coverts and their patterns in *mexicanoides*, 93% of the 115 individuals examined for this feature showed various barred patterns, and fully 67% exhibited a single pattern (simple, barred pattern). Six additional barred patterns were noted, while five different horseshoe-tipped, six V-striped, and one all black patterns were also observed. Although enough patterns were evident to indicate that *mexicanoides* has the potential for development of all major types, the number of individuals actually showing patterns other than of the barred type was small. Only four individuals showed no trace of the barred type of pattern. Nine birds exhibited *two* patterns of the same or different types, either by having the central coverts bi-patterned (feathers with one pattern basally, and another distally), or by showing asymmetry (one covert with one pattern, the other with another pattern). No geographical variation was noted, nor was there an indication of a sexual difference in patterns in these flickers.

Amount of Black in Tail

The extent of the black color at the tip of the tail was determined by use of three measurements: 1) the length of the black area from the tail tip toward the tail base; 2) the length of the black area on one central rectrix from its tip toward its base; and, 3) the extent of black along the shaft of the outer rectrix (rectrix 5) from its tip toward its base. Mean values for these in males are: 1) total extent—39.29 mm, 2) R1—43.12 mm, and, 3) R5—9.87 mm. There is considerable individual variation, but geographic variation is not marked. The latter is suggested by the data, and confirmed by statistical treatment of data for black in the outer rectrix (the measurement showing greatest variation among the five samples). Applying an analysis of variance test to the data from the four largest samples (all but El Salvador), an F value of 3.09 was attained, yielding $P = 0.05$–0.10. The difference is not highly significant, for the chances are one in ten to one in 20 that all four samples are drawn from the same population. Comparable results were obtained from data for females which showed about 2% less black than males. Since this is nearly equivalent to the size difference between the sexes, there appears to be no sexual difference in the extent of black in the tails of these flickers.

Tail Barring

Barring in the tail of *mexicanoides* tends to be less prominent than in more northern populations of *Colaptes auratus*, and much less than in the *chrysocaulosus* group (Short, 1965*b*). An exception is the inner (central) rectrix, which is as heavily barred as in *chrysocaulosus*, and more strongly barred than in the other groups. Thus, rectrix one has an average of 3–5 bars in *mexicanoides* (mean 4.10 for 42 males and 4.53 for 43 females from all samples), compared with 4–5 bars in *chrysocaulosus* and (usually) 1–2 bars in populations of the other groups. The outer rectrices, however, average 2.25 bars in 71 male *mexicanoides*, and 3.04 in 51 females (compared with 7–8 bars in *chrysocaulosus* and 3–5 bars in the *auratus* and *cafer* groups). Females tend to be more barred than males, both on rectrix 1 and 5. Rectrices 2–4 are unbarred, or with the barest traces of a bar on number 2. No geographic variation was evident in this character.

Nuchal Patch

The *auratus* and *chrysocaulosus* subspecies groups possess a red nuchal patch generally lacking in the other groups. Some individuals of the *mexicanoides* group show a partial nuchal patch, and Test (1940) noted the presence of a patch in three of 31 *mexicanoides* he examined. Individuals were scored for the nuchal patch character as previously described (Short, 1965*a*). Briefly, a full nuchal patch is scored "0," a restricted, but unbroken one—"1," a broken patch with several areas of red—"2," a trace or traces of red in one or several feathers—"3," and the nuchal patch entirely absent—"4." All 64 females examined lacked red in the nuchal area, thus scoring "4." One-quarter of the males (20 of 80) showed some indication of red nuchal coloring, with four individuals scoring "2" and 16 scoring "3." The mean score for all males was 3.71 (SE = 0.06). As might be expected with a feature found in only a small part of the population, sample sizes are not adequate to demonstrate geographic variation, or the lack of it, in the nuchal patch character for males. The number of males scoring "2" and "3" in each sample is as follows: Chiapas—6/17, Guatemala—3/27, El Salvador—2/7, Honduras—5/21, and Nicaragua—4/8.

Throat Color

The throat of *mexicanoides* is gray, about as in the *cafer* group, but slightly darker. Signs of brown or tan color were observed on the throats of 25 of 112 adults taken from late winter to early summer. This approach to the mixed tan and gray throats of most juvenile flickers was not noted in the other subspecies groups. More females than males showed tan or brown coloring (17 of 55 females, 8 of 57 males—a Chi-square test shows this difference to be significant at the $P = 0.01$ level), and the only two individuals showing nearly as much brown and tan as gray were females. The tendency for brown or tan color to develop appears more pronounced in the southeastern populations. All eight males showing such color came from the southeastern three samples, while 12 of the 17 females do so. All four Nicaraguan females show brown or tan coloring, and two of these are the birds with the most extensive development of these colors. Chiapan and Guatemalan samples include no males and but five females with such tan or brown coloring. It is likely that the mixed colors of the throats of these southernmost flickers, and those of juvenile birds as well, reflect a past condition when both gray and tan colors had developed, but before stabilization of one or the other had taken place. Fall birds show still more brown and tan present. Seasonal variation involves wear and fading, causing the throat to become grayer through the fall, winter, and spring.

Color of Ear Coverts

The ear covert area includes the auricular feathers and feathers of the subocular region (forward to the bill). This entire area is generally colored like the throat in all forms of *Colaptes auratus*, and is thus gray in *mexicanoides*. Apparently genetic control of the coloring of this area is relatively independent of that involved with throat color, as indicated by studies of hybridization (Short, 1965*a*). Although tan color is present in the otherwise gray ear coverts of some *mexicanoides*, it never approaches comprising 50% of the ear-covert area. Unlike the case of throat color, more males than females (17 of 80 ♂♂, 10 of 63 ♀♀) show tan or brown color, although the difference is not significant. Geographical variation is not evident, for Honduran and Chiapan samples contain greater numbers of individuals with tan or brown traces, while only one Nicaraguan (of 12), two Salvadoran (of 13), and eight Guatemalan (of 55) individuals exhibit such traces. Southeastern samples thus contain proportionally as many birds with brown and tan traces as do the northwestern samples.

Color of Under Wings and Tail (= "Shaft" Color)

Shaft color in *mexicanoides* varies from orange to (rarely) salmon-pink. As in other populations of *C. auratus*, there is no sexual difference in this character. Shaft color was scored as in studies of hybridization in flickers (Short, 1965*a*). The scores attained were "3," "3.5," and "4." A score of "4" denotes the salmon-pink color normally found in the *cafer* subspecies group. A score of "3" indicates orange shaft color, as found in some hybrids between the *auratus* and *cafer* subspecies groups. The intermediate orange-salmon color was scored "3.5." The mean score for 159 adults taken from late winter to summer was "3.26," with two standard errors = 0.06 and one standard deviation = 0.37. Means for the two sexes considered separately were: ♂♂ (90) = "3.29," ♀♀ (69) = "3.26."

Four birds showed yellowish in certain feathers. Three of these have very pale shaft color overall, and one (Mus. Comp. Zool. No. 121036) has yellowish-orange in rectrices 3–5 on the right side, while the same feathers are orange-pink on the left side. This yellow tendency is probably related to dietary factors and effects of fading as discusssed elsewhere (Short, 1965*a*). No individual of *mexicanoides* exhibited a symmetrical pattern of bright yellow-orange shaft color in one, several or all remiges and rectrices, as typically found in hybrids between the *auratus* and *cafer* groups. Mean shaft color scores ranged from "3.06" for Honduras to "3.46" for Nicaragua. No clinal variation is evident, but Honduran flickers seem to be more uniformly orange-shafted than those from elsewhere. In the other four samples, from 40 to 70% of the individuals scored "3.5" and "4," and, overall, 50% (51 of 102) of the birds in all four samples exhibited such scores. However, only 7% (3 of 41) of Honduran birds scored "3.5" or "4." The Honduran sample is thus significantly different in this respect from the others, including the Nicaraguan sample (in which nine of 13 birds scored "3.5" or "4"). The meaning of this difference in unclear.

Crown Color

There is some variation in crown color in *mexicanoides*, with southeastern birds tending to have paler, more cinnamon-rufous crowns and northwestern flickers exhibiting more rufous-chestnut coloring. There is overlap even between individuals of the extreme (Nicaraguan and Chiapan) samples. Variation in color of the crown with respect to hybridization between the *cafer* and *auratus* subspecies groups has been discussed elsewhere (Short, 1965*a*). There is no evidence of gray traces in the crowns of specimens of *mexicanoides*; all thus score "4" (typical non-gray, usually brown, crown of

cafer subspecies group). However, *mexicanoides* has a rufous, rather than the brown, crown of the *cafer* group (an approach toward *mexicanoides* is evident in some *mexicanus* individuals, and in *rufipileus* of the *cafer* subspecies group, as well as in all races, especially *tenebrosus*, of the *chrysoides* group). Traces of red coloring were evident in the crowns of four Honduran, one Chiapan, and one El Salvador males (traces in six of 48 males, or 13% of all males). Test (1940) reported red in the crowns of three of 17 *mexicanoides* males. The red, when present, appears primarily in the lores and secondarily in the feathers of the forehead. The crown feathers become lighter in color over the course of the year, following the annual molt. There are no apparent sexual differences in this feature.

Character Index Analysis

In order that all forms of *Colaptes auratus* be treated in a standard manner for comparison of character (or hybrid) index values, the same scoring system utilized in the study of hybridization between the *cafer* and *auratus* subspecies groups (Short, 1965*a*) was applied to *mexicanoides*. The six index characters are: crown color, throat color, ear covert color, extent of nuchal patch, malar color (males) and shaft color. Scores for each character ranged from "0" for the extreme *auratus* group condition, to "4" for the condition found in the *cafer* subspecies group (races *collaris*, *cafer*). Possible character index values thus range in males (six characters) from 0 for an individual registering the *auratus* condition in all characters to 24 for a bird having a *cafer*-like condition of each character. The corresponding values for females (five characters) range from 0 to 20.

Character index values ranged from 19–23 in 87 males of *mexicanoides* and from 17–20 in 63 females. The means with two standard errors are: males—21.46 ± 0.20, and females—18.79 ± 0.18. Of course, variation in index values is dependent upon variation in the separate characters making up the index. Thus, males vary considerably due to variation in nuchal, malar, and shaft color. Females exhibit less variation in index values because they lack one feature variable in males (malar character), and because they show no nuchal variation. Crown color is non-variable in both sexes, as far as hybrid index scoring is concerned (crown color varies in other ways, as noted above). Crown color of *mexicanoides* is assigned a score of "4," as in the *cafer* group, because the rufous-chestnut color exhibited is closer to the browns of that group than to the grays of the *auratus* group. Sample means varied from 21.22 to 21.81 for males, and from 18.25 to 18.94 for females. In terms of those characters important in describing effects of hybridization between the *cafer* and *auratus* groups, *mexicanoides* indexes near the former.

DISCUSSION

The variation encountered within the *mexicanoides* group of populations, as indicated by available specimens, is largely clinal. For most characters

major clinal "steps" are not evident. The El Salvador sample, representing the area intermediate between the extreme Chiapan and Nicaraguan populations, is variously intermediate between them in most features. In some characters, such as tail length, P10 : P9 ratio and breast spotting, the El Salvador sample is closest to the adjacent Guatemalan birds, while in others (e.g., depth of breast patch and bill length) it is closer to those from Honduras. Nicaraguan flickers are not represented by an adequate sample, but certainly appear to differ in average features from birds farther to the north.

If no flickers occurred in the intervening area between Chiapas and Nicaragua, the differences between birds in these extreme regions would merit separate subspecific treatment for them. However, these extreme populations are connected by intermediate populations. Furthermore, for most features, variants in the Guatemalan, and even the Chiapan samples, overlap with one or more birds in the small Nicaraguan sample.* This fact, plus the clinal nature of variation for many characters, and the considerable variation encompassed within each of the larger samples (Honduras, Guatemala), militate against subspecific recognition of the Nicaraguan population.

Dickey and van Rossem (1928) described the race *pinicolus* from El Salvador. Those authors were unable to appreciate the variation and clines in *mexicanoides*, for they saw no Nicaraguan and Honduran specimens (op. cit., p. 131). As noted above, the El Salvador population is variously intermediate between those of Honduras and Guatemala (and hence between Nicaraguan and Chiapan populations), and this intermediate population does not merit a trinomial name. Stone (1932:316) was unable to distinguish *pinicolus* from *mexicanoides* and I follow Stone in considering *pinicolus* a synonym of *mexicanoides*. The subspecies group *mexicanoides* is thus comprised of the single subspecies *mexicanoides*.

The diagnostic features of this subspecies group are:

1) wings more rounded than in other subspecies groups (except *chrysocaulosus* group)
2) breast markings generally broad, bar-like
3) breast patch deeper, less crescentic (as in *chrysocaulosus* and *chrysoides* subspecies groups)
4) malar patch mixed red and black in males and cinnamon-rufous in females
5) back bars deeper, more numerous than in other groups of *Colaptes auratus* (similar to pattern found in the South American flicker subgenus *Soroplex*)
6) back tends to be tricolored (buff, brown, and black), especially in the southeastern populations
7) rump patch moderately obscured by spots and/or bars, nearly to the extent found in the *chrysocaulosus* group

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* Additional (4♂♂, 11♀♀) Nicaraguan specimens recently examined in the British Museum enhance this overlap.

8) "shaft" color generally orange to orange-salmon, less pink than in the *cafer* subspecies group
9) crown deep rufous-chestnut in color, approached but not attained by certain populations of the *cafer* group

Characteristics of the subspecies *mexicanoides* are those of the *mexicanoides* subspecies group.

The Central American flickers, although distinctive, show certain color pattern resemblances to the *cafer* and *chrysoides* subspecies groups. These include:

1) all have a basically "brown" crown
2) all have a gray throat
3) all have a predominantly red malar patch in males

Additionally, *mexicanoides* shares with the *cafer* group the generally reddish color of the "shafts." In certain respects noted above, *mexicanoides* resembles the *chrysoides* and *chrysocaulosus* groups more than it does the *cafer* group. In still other features it shows resemblances to the *chrysocaulosus* group, but not to the *cafer* and *chrysoides* groups. *Mexicanoides* is least similar to the *auratus* group. The significance of these resemblances and differences in terms of the past history of flickers will be discussed elsewhere. It is apparent, however, that the distinctive features of the *mexicanoides* group preclude the inclusion of the subspecies *mexicanoides* in the subspecies group *cafer*, with which it is generally associated. The subspecies of the *cafer* group (*cafer, collaris, nanus, mexicanus,* and *rufipileus*) generally exhibit clinal variation, and not even the well-differentiated race *rufipileus* approaches the level of morphological distinctiveness evident in *mexicanoides*. The Central American flickers show the effects of long isolation from other North American flickers. While *mexicanoides* appears not to have differentiated to the species level, its features warrant its equal status within *Colaptes auratus* as a subspecies group along with the *auratus, chrysocaulosus, cafer,* and *chrysoides* subspecies groups.

SUMMARY

The North American flicker, *Colaptes auratus*, is represented in Central America by a population exhibiting distinctive morphological features. Variation within the Central American population, occupying the highlands of Chiapas, Guatemala, El Salvador, Honduras, and northern Nicaragua, is mainly clinal. Clines for the various characters appear to be concordant, from northwest to southeast; however, the number of specimens available was inadequate to show variation, or lack of it within major areas with diverse topography, such as Honduras. The northwestern birds (Chiapas) tend to be larger, darker, and less barred below than those from the southeastern populations. The clinal nature of the variation, overlap among individuals of the extreme populations, and intrasample variation do not permit recognition of a second subspecies in the *mexicanoides* group of flickers. The race *pinicolus* Dickey and van Rossem is held invalid, for the

El Salvador population is intermediate between those of Chiapas and Nicaragua.

Characteristics of the *mexicanoides* subspecies groups of *Colaptes auratus* are presented. This group shows similarities with each of these subspecies groups: *chrysocaulosus*, *cafer*, and *chrysoides*. It differs in a number of important ways from the *cafer* group, and merits equal status with the four other subspecies groups (*auratus*, *cafer*, *chrysocaulosus*, and *chrysoides*) of *C. auratus*.

ACKNOWLEDGMENT

The opportunity to continue my investigations of flickers, including the present one, was provided by a fellowship award from the Chapman Memorial Fund Committee of the American Museum of Natural History, where much of the work was done. Drs. Dean Amadon and Wesley E. Lanyon and the staff of the museum were most helpful. Dr. Charles G. Sibley provided assistance and encouragement during early phases of my flicker investigations. The Karl P. Schmidt Committee of the Chicago Natural History Museum in 1961 gave me a travel grant, and the Louis Agassiz Fuertes Research Grant Committee of the Wilson Ornithological Society in 1956 provided me with a Fuertes award, for both of which I am grateful. Dr. Kenneth C. Parkes was especially helpful with suggestions benefiting the manuscript.

I wish to thank the following individuals and institutions for the loan of specimens essential to this investigation, and for assistance rendered during visits to certain of the institutions: American Museum of Natural History (Dr. Dean Amadon), Dickey Collection of the University of California at Los Angeles (Dr. Thomas R. Howell), Museum of Vertebrate Zoology of the University of California at Berkeley (Dr. Alden H. Miller), Carnegie Museum (Dr. Kenneth C. Parkes), Chicago Natural History Museum (Mr. Emmet R. Blake) Florida State Museum of the University of Florida (Dr. Oliver L. Austin, Jr.), Moore Laboratory of Zoology of Occidental College (Dr. J. W. Hardy), Museum of Comparative Zoology of Harvard University (Dr. Raymond A. Paynter, Jr.), Philadelphia Academy of Sciences (Mr. James Bond), and the U.S. National Museum (Mr. Herbert G. Deignan).

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